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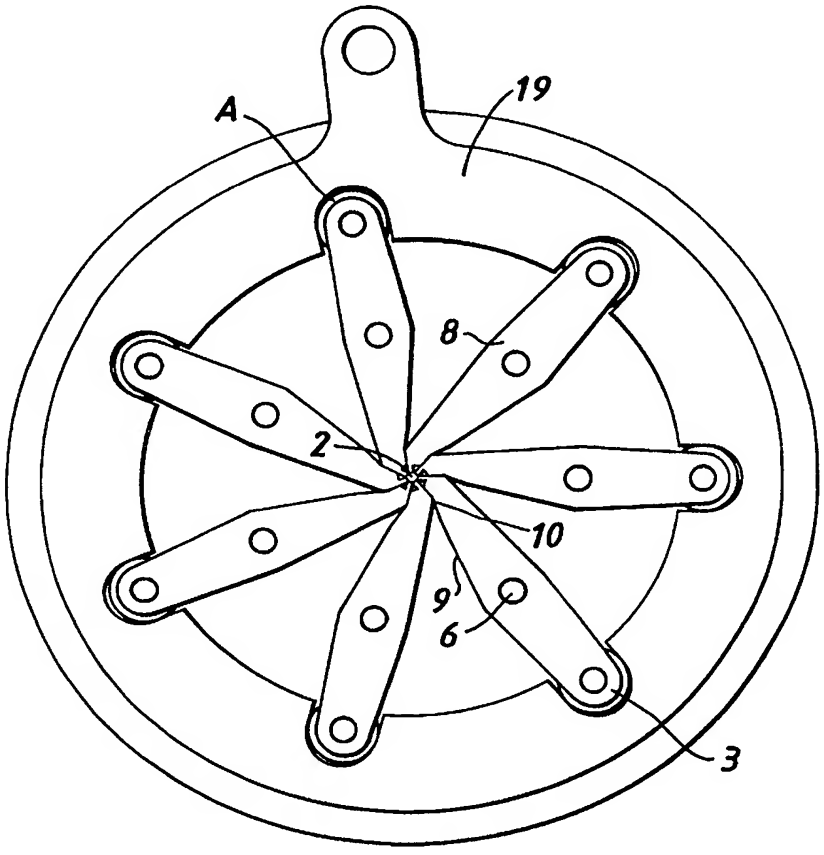
(54) Title: TAMPON

(57) Abstract

A "star" tampon comprising an essentially cylindrical shape of non–woven material, which is provided with an odd number of 7 or more longitudinal ribs and an odd number of 7 or more longitudinal grooves; a process of manufacturing such a tampon, which comprises radially pressing an essentially cylindrical tampon blank over an odd number of 7 or more longitudinal portions, preferably also allowing or causing the tampon blank to rotate while being compressed; and a tampon press for manufacturing such a tampon, which comprises an odd number of 7 or more mutually adjacent radially movable dies defining the circumference of at least a part of an essentially cylindrical aperture for housing a tampon blank.



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TAMPON

This invention relates to a novel form of tampon, and a process and apparatus for its manufacture.

'Star' tampons are known, inter alia, from British Patent No.1082770. European Patent Application No.EP-A-0422660 also describes a method and apparatus for manufacturing a tampon. This comprises compressing a tampon blank radially to its longitudinal mid-axis over an even number of at least 6 portions mutually adjacent in the circumferential direction. The tampon produced possesses an even number of longitudinal ribs the outer ends of which form a soft essentially smooth cylindrical surface and has a central approximately circular highly compressed fibre core.

Method and apparatus for manufacturing 'Star' tampons are also described in European Patent Application No.EP-A-0639363. The tampons described therein possess a core comprising a high-density region of ring shaped cross-section and a central region of average density. However, the tampons also possess an even number of longitudinal ribs.

It is clear from the prior art that it has hitherto been considered that a 'Swiss-roll' cylindrical tampon blank needs to be pressed using an equal number of compression points. The original 'Swiss-roll' tampon described in GB 1082770 required eight compression points, four that were deep into the cotton and/or rayon fibre roll and four that were flat to 'round off' the surface of the tampon. It is notable also that the larger diameter tampons required ten ribs to provide a stable tampon in use.

Recent work has described method and apparatus, and given reasons, for using eight compression points to equidistantly indent the

tampon and provide products that have a greater specific density at the centre of the tampon compared with the outer. Again, it has been found that tampons of a larger dimension required more, i.e. ten, compression points or ribs.

It has generally been held that an even number of longitudinal ribs is necessary such that during manufacture each compression member has an equal and opposite compression member thus preventing the tampon blank from distorting.

Thus, it has generally been held that an even number of tampon press jaws extending longitudinally of a tampon blank that is to be pressed is necessary to ensure that in manufacture each jaw has this equal and opposite balancing effect of the opposite jaw.

Furthermore, often half of the jaws have previously been used in tampon production to pre-press the initial roll just before the second half set of jaws completing the final pressing of the tampon blank, in particular for products that have a greater specific density at the centre of the tampon compared with the outer.

Again, it has been found that tampon presses are often designed so that the jaws effecting the pressing of the tampon blank pass along a line through the longitudinal axis of the tampon blank.

We have now surprisingly found that tampons can be pressed with an odd number of 7 or more jaws (also known as dies) and in a symmetrical and equidistant and/or concentric pressing action to produce a tampon with enhanced properties over prior art tampons.

Thus according to the invention we provide a tampon comprising an essentially cylindrical shape of non-woven material, characterised by

being provided with an odd number of 7 or more longitudinal ribs and an odd number of 7 or more longitudinal grooves.

The term 'essentially cylindrical' is used herein for the shape of:

the tampon,
any tampon blank from which the tampon may be made, and
any aperture for housing a tampon blank or tampon in the production of the latter.

The term 'aperture for housing a tampon blank' includes, for example any suitable apparatus component such as a conduit, duct, hole, opening or passageway, e.g. in a tampon press, defined by the dies that in use press a tampon blank.

It includes, for example those where the circumference of the object is not even or smooth. Examples include those where the circumference of the tampon, blank or aperture undulates, and/or bulges or protrudes locally.

It also includes, for example those where one or more ends of the tampon or blank are not planar, flat and/or smooth, transverse surfaces.

Examples include tampons or blanks that are torpedo- or cigar-shaped, in which the curved ends may be even or smooth or again their circumferences may undulate and/or bulge or protrude locally.

The tampons of the invention are advantageous in that a tampon of any size, from mini through to the largest dimension, can be produced without the need to change the number of grooves between tampon sizes.

A further advantage is that the tampons of the invention have improved stability with reduced specific density.

This means that a greater range of weights of products can be made within a given size than has, hitherto, been possible.

The tampons of the invention will generally comprise a core of high-density material but wherein the longitudinal ribs are of low-density material.

Optionally, the high-density core may be analogous to that described in EP-A-0422660. Alternatively, it may comprise a central region of low-density material with a surrounding annular or toroidal region of high-density material.

In prior art tampons, such as those described by EP '660, it is considered essential that only the outer ends of the longitudinal ribs touch.

However, this is not the case with the tampons of the present invention.

The number of ribs and grooves in the tampon of the invention may be varied, provided that they represent an odd number of 7 or more.

Thus, the number of each of the ribs and grooves may be 7, 9, 11 or greater. However, we have found that tampons with 7 ribs and grooves are especially advantageous, and more especially if these are all of the same depth and equally spaced around the circumference of the tampon blank.

A further preferred tampon feature is a 'density profile' of the tampon with a high-density core, e.g. analogous to that described in EP-A-0422660, with a surrounding annular or toroidal region of low-density material in the outer ribs.

According to a further feature of the invention we provide a process of manufacturing a tampon as hereinbefore described which comprises radially pressing an essentially cylindrical tampon blank over an odd number of 7 or more longitudinal portions which are mutually adjacent around the circumference of the tampon blank.

The term 'radially ' is not intended to be limiting to pressing only in a direction along a radius of the essentially cylindrical tampon blank.

It also includes, for example a pressing that has a direction of movement with a component along a radius of the essentially cylindrical tampon blank, but also has, for example a component of its direction of movement that is tangential or along the circumference of the blank.

It thus includes, for example any embodiment of the process of manufacturing a tampon as hereinbefore described that not only comprises pressing the tampon blank radially but also allowing or causing the tampon blank to rotate whilst being compressed.

A tampon produced by this embodiment of the process for manufacturing a tampon as hereinbefore described has the general advantages inter alia of the tampons of the invention of improved stability with reduced specific density and of avoiding the need to change the number of grooves between tampon sizes.

A further advantage is that the tampons of from this embodiment of the process also have improved stability properties with greater inter fibre cohesion, owing to the rotary movement of the tampon blank.

This is in particular so for products that have been formed from smooth cylindrical 'Swiss-roll' tampon blank of the type described in GB 1082770 that is allowed to rotate whilst being compressed.

A tampon of this type produced in this way with a compressed fibre core of greater specific density at the centre of the tampon compared with the outer is particularly advantageous.

In the general process of the invention, the radial pressing of an odd number of 7 or more longitudinal portions that are mutually adjacent around the circumference is effected in a symmetrical and equidistant and/or concentric pressing action.

The radial pressing may however as desired be effected in one or more steps on the tampon blank, each pressing action to produce a tampon with the desired properties being a symmetrical and equidistant and/or concentric pressing action.

Thus, radial pressing to create nine identical longitudinal ribs and the same number of identical longitudinal grooves may be effected:

a) in one step on the tampon blank, with nine simultaneous pressing actions to produce a tampon with the desired properties, or

b) in two steps in an embodiment of the process characterised by using three symmetrical indentations to start the formation of the tampon with three pairs of subsequent symmetrical indentations interspersed between each pair of the first three, provided in a second step.

All the indentations, whether provided in the first or second step, give rise to the longitudinal ribs and grooves that it is desired to create around the circumference of the tampon blank of the same depth.

An embodiment of the process for manufacturing a tampon as hereinbefore described that is designed to apply pressure to the tampon blank to produce the final tampon form in a single step is a preferred process.

One that also provides seven longitudinal ribs and grooves is especially advantageous, and more especially if these are all of the same depth and equally spaced around the circumference of the tampon.

A further preferred process feature is one designed to apply pressure to the tampon blank to produce the final tampon with a 'density profile' with a high-density core, e.g. analogous to that described in EP-A-0422660, with a surrounding annular or toroidal region of low-density material in the outer ribs.

The tampon blank used in the method and apparatus of the invention is generally produced by conventional method and apparatus known *per se.*

For example, the tampon blank may comprise a strip of non-woven material wound in a 'Swiss-roll' fashion to produce an essentially cylindrical blank.

The strip material will usually comprise a sealing strip section at one edge of the strip material. This will be such that, when the strip material is rolled, the sealing strip section will remain on the outside of

the rolled material. It can then be wrapped around the 'Swiss-roll' and sealed upon itself to produce the tampon blank.

Such tampon blanks are described in European Patent Application No.EP-A-0149155 and are incorporated herein by reference.

The prior art describes that the sealing strip section, e.g. a liquid permeable thermoplastic strip section, should be of a length that approximately corresponds to the circumference of the tampon blank.

However, within the scope of the invention the thermoplastic strip may be of a greater or, more preferably, smaller, length than the circumference of the tampon blank, for example 50% of the circumference of the tampon blank.

Tampon blanks used herein may comprise bicomponent materials as described in the prior art. However, the blanks used herein may optionally be mono- or multi-, i.e. three or more, component materials.

According to a further feature of the invention we provide a tampon press which comprises mutually adjacent dies defining the circumference of at least a part of an essentially cylindrical aperture for housing a tampon blank and capable of radial movement with respect to the tampon blank, characterised by being provided with an odd number of 7 or more dies.

The dies defining the circumference thus extend longitudinally along the essentially cylindrical aperture for housing a tampon blank.

The odd number of 7 or more dies defining the circumference will generally correspond to each of the odd number of 7 or more

longitudinal ribs and odd number of 7 or more longitudinal grooves that it is desired to create around the circumference of the tampon blank.

The press is adapted to effect the process of the invention by radial pressing of an odd number of 7 or more longitudinal portions that are mutually adjacent around the circumference of the tampon blank.

However, within the scope of the invention, this may be done in one or more steps on the tampon blank, the press being set up for a radial pressing action that is symmetrical and equidistant and/or concentric in each step.

Thus, the press may be set up to create nine identical longitudinal ribs and the same number of identical longitudinal grooves in one step on the tampon blank. This has nine essentially identical jaws (also known as dies) in a symmetrical and equidistant and/or concentric array.

Tampons can also be produced using three essentially identical jaws (also known as dies) in a symmetrical and equidistant and/or concentric array to start the formation.

This may then be completed by the action of a further six essentially identical jaws in a symmetrical and equidistant and/or concentric array of three pairs of secondary press jaws interspersed between each pair of the first three.

This gives a radial pressing action that is symmetrical and equidistant and/or concentric in a second step.

All nine jaws finish up in the centre of the tampon in an equidistant formation.

A press designed to apply pressure to the tampon blank to produce the final tampon form in a single step is a preferred tampon press.

One that also provides seven longitudinal ribs and grooves around the circumference of the tampon blank is particularly advantageous, and more especially if these are all of the same depth and equally spaced around the circumference of the tampon.

A further preferred press feature is one designed to apply pressure to the tampon blank to produce the final tampon with a 'density profile' with a high-density core, e.g. analogous to that described in EP-A-0422660, with a surrounding annular or toroidal region of low-density material in the outer ribs.

The radial movement with respect to the tampon blank will be limited at the inwardmost section of traverse to leave a high-density core, optionally a mono- or multi-component core.

Such a limit at the inwardmost section of traverse may be adjusted so that the core is a denser multi-component core that comprises a central region of lower density material.

The term 'capable of radial movement' is not intended to be limiting to movement of any die only in a direction along a radius of the essentially cylindrical aperture for housing a tampon blank.

It also includes, for example any die that has a direction of movement with a component along a radius of the essentially cylindrical aperture, but also has, for example a component of its direction of movement that is tangential or circumferential.

It thus includes, for example any press apparatus (as in the accompanying drawings) in which each die defining the aperture for housing a tampon blank is essentially a lever that is rotatable about a fixed fulcrum point.

The fulcrum and the lever are usually mounted such that the point of the die (also known as the press jaw) describes a series of gentle forward and backward arcuate strokes throughout the tampon pressing action.

Such an arcuate path will often be designed to pass through or near the longitudinal axis of the tampon blank.

Such an arcuate pressure designed to pass through or near the longitudinal axis of the tampon blank, together with adjustment of other parameters can allow or cause the tampon blank to rotate whilst being compressed.

Parameters that allow or cause the tampon blank to rotate whilst being compressed include the profile and depth of the press jaws in combination with the fibres used in making the tampon.

A tampon produced by this embodiment of the press, which can allow or cause the tampon blank to rotate whilst being compressed, is a preferred tampon, as hereinbefore described.

The tampon press of the invention will thus preferably have such a fulcrum point for each die.

Such a press designed to apply pressure to the tampon blank to produce the final tampon form in a single step is a preferred tampon press.

One that also provides seven longitudinal ribs and grooves around the circumference of the tampon blank is particularly advantageous, and more especially if these are all of the same depth and equally spaced around the circumference of the tampon.

A further preferred press feature is one designed to apply pressure to the tampon blank to produce the final tampon with a 'density profile' with a high-density core, e.g. analogous to that described in EP-A-0422660, with a surrounding annular or toroidal region of low-density material in the outer ribs.

Factors that are critical in effect on the density of the central region include the shape of the 'point' of the die and/or press jaws, the depth of the press jaws, the dwell time, and the fibre response and/or 'set' or 'memory' of the fibres used in making the tampon.

The pressure and dwell time in conjunction with the profile and depth of the press jaws can be varied in combination with the fibres used in making a tampon to achieve the structure that it is desired to create.

This is especially the case for features such as the particular type of profile and depth of the longitudinal ribs and grooves that it is desired to create around the circumference of the tampon blank.

Once pressure on the tampon blank to produce the initial compressed 'star' tampon is released, and before any further processing, recovery of the pressed tampon blank will occur to a greater or, more preferably, lesser extent circumferentially in the tampon blank.

For example, expansion circumferentially of the tampon ribs into the series of grooves around the circumference of the tampon blank is particularly frequent.

This may more especially occur to the extent that the outer part of the ribs form into lobes, which overlie the series of grooves around the circumference of the tampon to form a series of inner void spaces.

Often the process of the invention is designed to pass the tampon after radial pressing through an aperture for housing the tampon snugly and capable of further radial compression of the tampon. This consolidates and determines the essentially cylindrical outer profile of the tampon.

The 'lower specific density' 'lobe' points may be caused by such further processing to overlie the series of grooves around the circumference of the tampon even further to form inner void spaces.

The outer shape of the die determines the 'fill' of the fibre and/or non-woven materials of the 'lobes' of the tampon, as described hereinbefore.

Again, the other main criterion involves the fibres themselves, which must have a 'memory set' otherwise great recovery of the pressed tampon blank will occur.

These may be adjusted as desired in order to produce the required properties of the tampon, e.g. by selecting a suitable multi-component or mono-component material for the blanks used herein.

The shape of the 'void' space created should determine the outer profile of the tampon in the 'lower specific density' 'lobe' points of the tampon.

A particularly preferred tampon press is a seven-jaw press with the particular type of profile and depth of the press jaws shown in the accompanying drawings.

The press will usually comprise a conventional cam action for actuating the jaws.

It is usually mounted such that the point of the die (also known as the press jaw) describes a circular arc series of gentle forward and backward strokes.

The aperture for housing a tampon blank may extend for example before and/or after the component part defined by the dies.

The component part defined by the dies will usually be essentially of the same length and diameter as the tampon blank, and thus usually of essentially uniform diameter.

It may however (as noted hereinbefore) be desired to create a general increase in, for example the density, cohesion, etc. in the tampon blank and/or tampon.

Thus, also within the scope of the invention, the part of the aperture for housing a tampon blank that extends for example before and/or after the component part defined by the dies (especially where this further feature is a duct, or passageway) may taper.

Such a tapering part after or before the part defined by the dies thus presses radially around the circumference of the tampon and/or tampon blank as it transits that tapering part. Any such portion of the aperture for housing a tampon blank that extends for example before and/or after the component part defined by the dies may of course also be of essentially uniform diameter over all or part of its length.

The invention will now be described, but in no way limited with reference to the accompanying drawings in which

Figure 1 is an axial view of the jaws of a nine-jaw press in 'open' position;

Figure 4 is an axial view of the jaws of the same nine-jaw press fully 'closed';

Figures 2 and 3 are views of the jaws of the same nine-jaw press at two stages of its use in the process of the invention Intermediate between the view of the same in Figures 2 and 3; and

Figure 5 is an axial view of the jaws and the cam for actuating the jaws of a seven-jaw tampon press with the jaws in 'closed' position in its use in the process of the invention.

With reference to Figures 1 to 4, a tampon press (1) comprises a series of fulcrum spindles (6) mounted in an array in which they are mutually equidistant around the circumference of a cylinder concentric with the longitudinal axis (2) of the tampon press (1), and parallel to the axis (2) of the tampon press (1). A series of essentially identical jaw lever arms (8) each has a boss (3) with and aperture (4) (not shown) for housing a fulcrum spindle (6), a surface (9) and shoulder (10), and also a die point (11), the profile of which determines the outer profile of the product tampon in particular of the lower-density' 'lobe' points of the tampon.

The press jaws (8) are each mounted with its boss (3) housing a fulcrum spindle (6), and with its surface (9) touching the shoulder (10) of an adjacent jaw lever arms (8) is mounted such that each is point. Each jaw lever arms (8) is thus rotatable about a fulcrum spindle (6) and the die points (11) define the circumference of a cylindrical aperture (12) for housing a tampon blank (5), which extends the length of the blank (5). In use, a tampon blank (5) is pressed by the series of dies (7). As the dies compress the tampon blank (6) to produce the longitudinal grooves, each jaw lever arm (8) describes a circular arc in a gentle forward stroke, with its shoulder (10) sliding along the surface (9) of an adjacent arm (8). This is shown in Figure 1 through Figures 2 and 3 to Figure 4, to define in particular the lower specific density' 'lobe' points of the tampon. This is followed by the backward stroke, as shown in Figure 4 through Figures 3 and 2 to Figure 1, to return the nine-jaw press to the 'open' position for the press cycle to be repeated on the a different or the same tampon. During the forwards stroke (as shown in Figure 1 through Figures 2 and 3 to Figure 4, the operation of the press (1) may cause the tampon blank (5) to rotate. In the figure illustrated, rotation would be in a clockwise direction although this is not intended to be limiting.

With reference to Figure 5, the press dies are in position and circles with crosses (6) show the fixed fulcrum points. A cam (19) operates the lever at 'A' (another larger circle) in a series of gentle upward and downward strokes. The cam (19) can be designed to indent, dwell, return, impress and finish off the tampon as desired in order to produce the required properties of the tampon. One partial rotation of the cam to the next jaw is equivalent to the pressing of one tampon. The cam lever attachment can be made in a variety of ways.

CLAIMS

1. A tampon comprising an essentially cylindrical shape of non-woven material, characterised by being provided with an odd number of 7 or more longitudinal ribs and an odd number of 7 or more longitudinal grooves.

2. A tampon according to claim 1 with 7 ribs and grooves, all of the same depth and equally spaced around the circumference.

3. A tampon according to claim 1 with a high-density core with a surrounding annular or toroidal region of low-density material in the outer ribs.

4. A process of manufacturing a tampon according to claim 1, which comprises radially pressing an essentially cylindrical tampon blank over an odd number of 7 or more longitudinal portions which are mutually adjacent around the circumference of the tampon blank.

5. A process according to claim 4, which is designed to apply pressure to the tampon blank to produce the final tampon form in a single step.

6. A process according to claim 4, which provides seven longitudinal ribs and grooves, all of the same depth and equally spaced around the circumference of the tampon.

7. A process according to claim 4, which is designed to apply pressure to the tampon blank to produce the final tampon with a high-density with a surrounding annular or toroidal region of low-density material in the outer ribs.

8. A process according to claim 4, characterised by allowing or causing the tampon blank to rotate whilst being compressed.

9. A tampon press for manufacturing a tampon according to claim 1, which comprises mutually adjacent dies defining the circumference of at least a part of an essentially cylindrical aperture for housing a tampon blank and capable of radial movement with respect to the tampon blank, characterised by being provided with an odd number of 7 or more dies.

10. A press according to claim 9, designed to apply pressure to the tampon blank to produce the final tampon form in a single step is a preferred tampon press.

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FIG. 1.

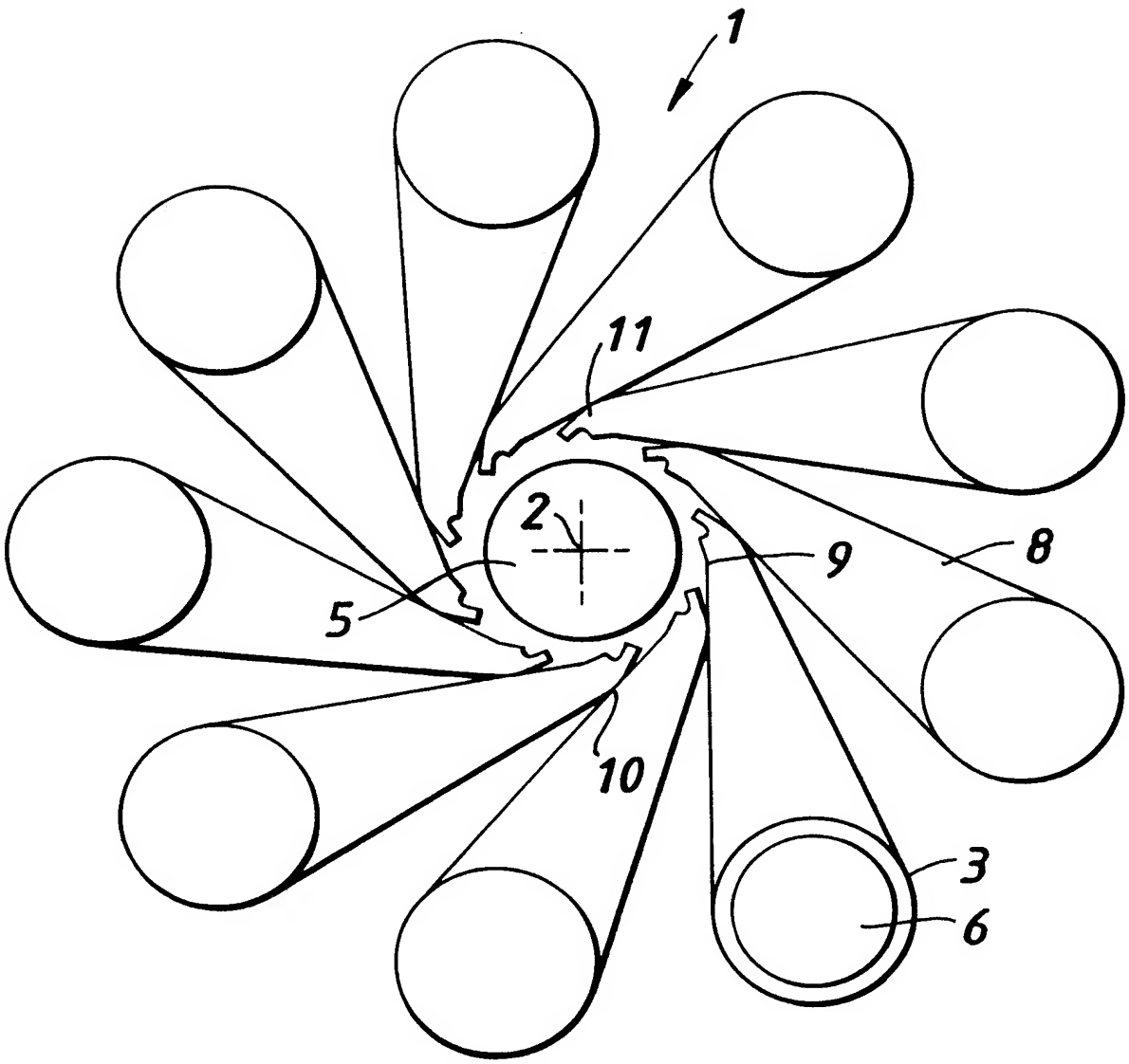

FIG. 2.

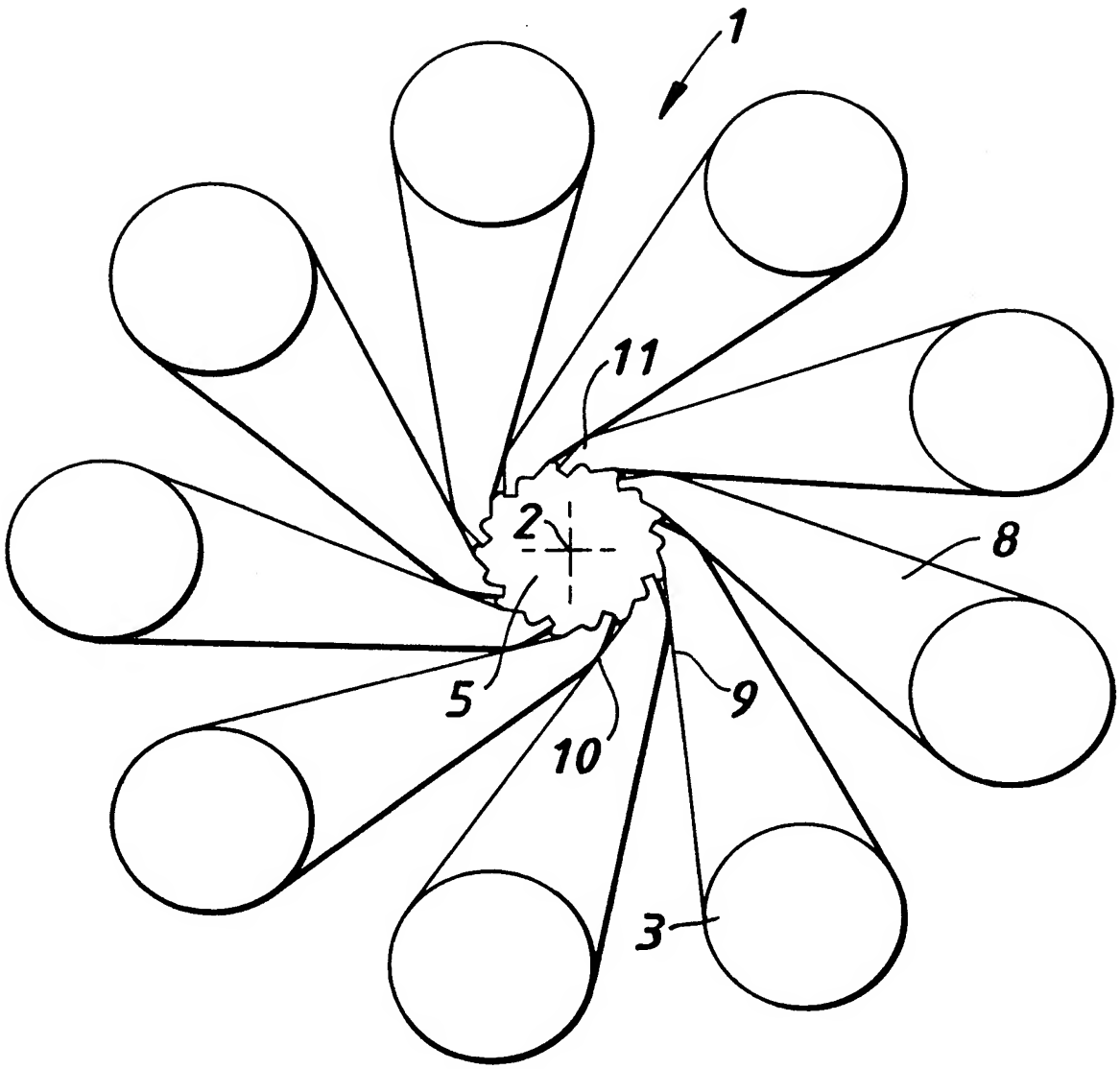

FIG. 3.

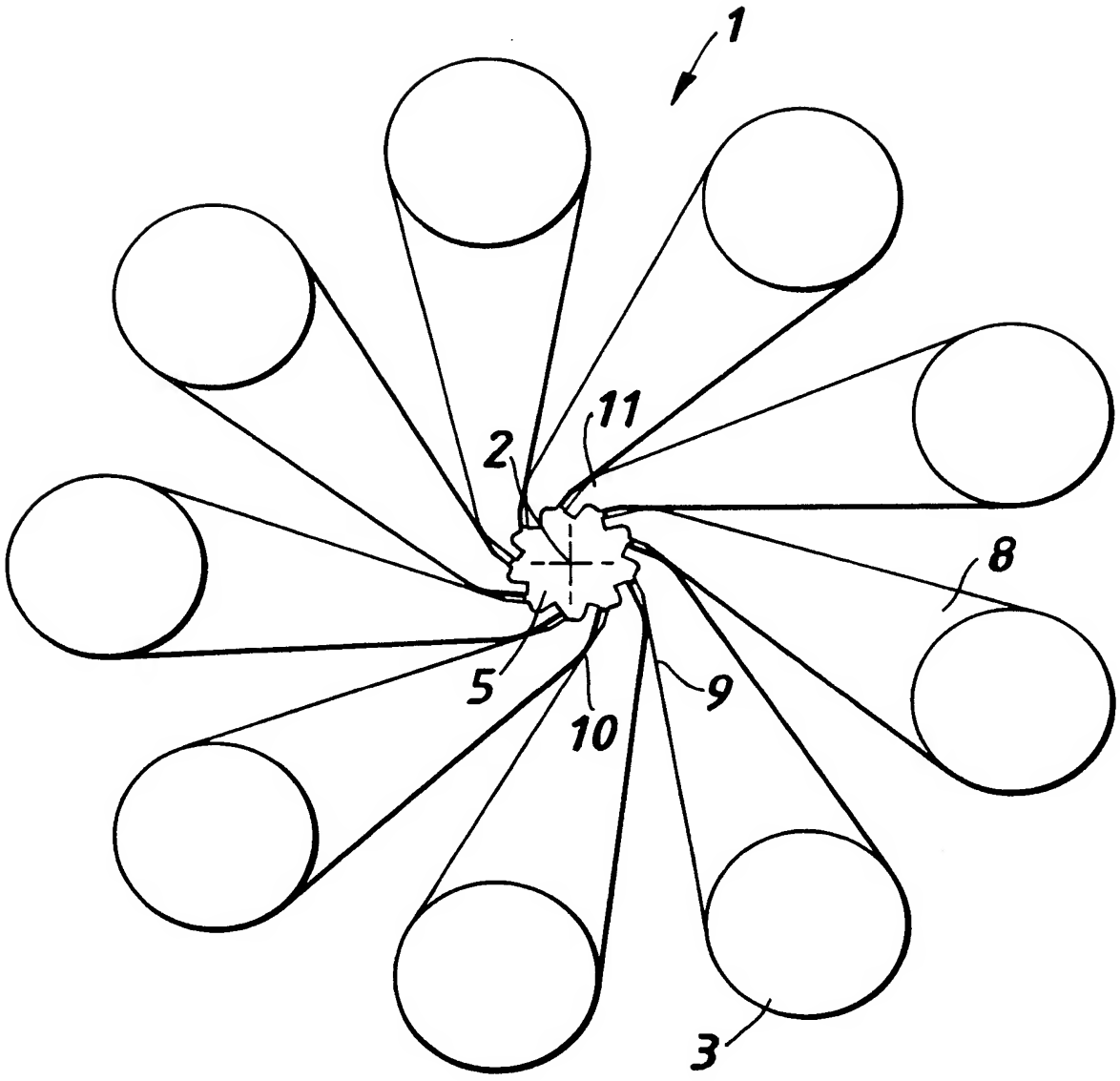

FIG. 4.

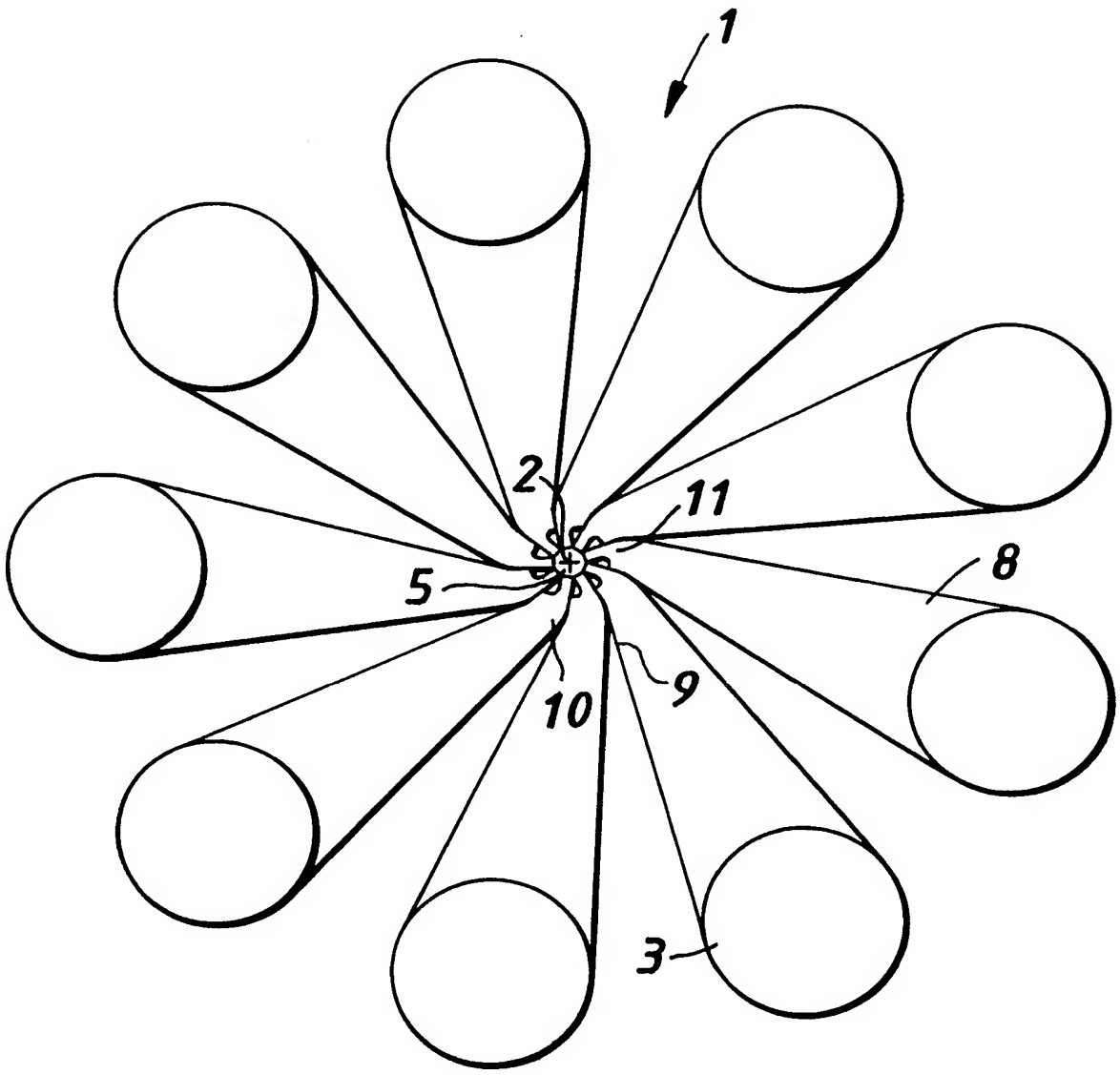

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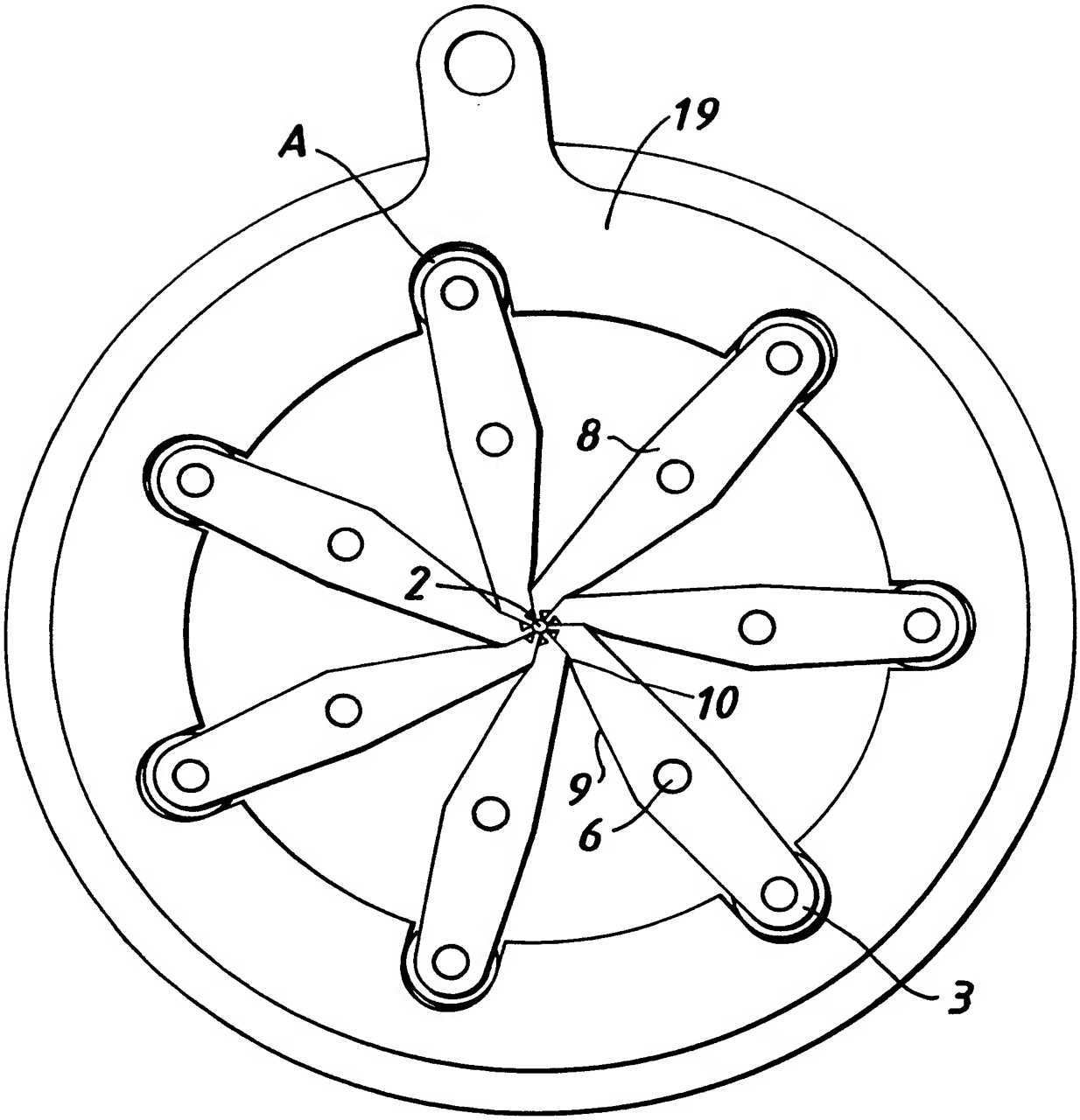
FIG. 5.



INTERNATIONAL SEARCH REPORT

Interi nal Application No
PCT/GB 00/00891

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 611 562 A (MCNEIL PPC INC) 24 August 1994 (1994-08-24) abstract column 6, line 13 - line 43 column 9, line 40 - line 49; figures 1,5-7	1-4,6,7, 9
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X	US 4 175 561 A (HIRSCHMAN SHALOM Z) 27 November 1979 (1979-11-27) figure 2	1-7,9,10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2000	19/06/2000

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European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Louter, P

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